

Appln No. 10/590,636
Amdt date January 23, 2009
Reply to Office action of October 30, 2008

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (Original) A clay-polyurethane nanocomposite comprising a clay and a polyurethane covalently bonded to the surface of the clay wherein the polyurethane is formed by reacting a clay-containing diisocyanate compound with a polyol, the clay-containing diisocyanate compound contains a diisocyanate compound covalently bonded to surface silanol groups of the clay and 0.5~5% by weight of the clay based on the diisocyanate compound, and the clay is exfoliated by the polyurethane such that no wide-angle X-ray diffraction (WAXD) peak is detected between 2° and 10° by XRD measurement.
2. (Currently Amended) The clay-polyurethane nanocomposite according to claim 1, wherein the diisocyanate compound is polymeric 4,4'-diphenylmethanediisocyanate (polymeric-MDI), monomeric 4'-diphenylmethanediisocyanate (monomeric MDI), or toluene diisocyanate (TDI).
3. (Original) The clay-polyurethane nanocomposite according to claim 1, wherein the clay is montmorillonite, bentonite, hectorite, fluorohectorite, saponite, beidelite, nontronite, stevensite, vermiculite, volkonskoite, magadite, kenyalite, or a derivative thereof.
4. (Original) The clay-polyurethane nanocomposite according to claim 1, wherein the clay is treated with an acid, an alkyl ammonium, or an alkyl phosphonium.
5. (Original) The clay-polyurethane nanocomposite according to claim 1, wherein the polyol is prepared by polymerization of: ethyleneglycol, 1,2-propaneglycol, 1,3-propyleneglycol, butyleneglycol, 1,6-hexanediol, 1,8-octanediol, neopentylglycol, 2-methyl-1,3-propanediol, glycerol, trimethylolpropane, 1,2,3-hexanetriol, 1,2,4-butanetriol, trimethylolmethane,

pentaerythritol, diethyleneglycol, triethyleneglycol, polyethyleneglycol, tripropyleneglycol, polypropyleneglycol, dibutyleneglycol, polybutyleneglycol, sorbitol, sucrose, hydroquinone, resorcinol, catechol, bisphenol, or a mixture thereof; and ethylene oxide, propylene oxide, or a mixture thereof.

6. (Original) The clay-polyurethane nanocomposite according to claim 1, wherein polyol is prepared by polymerization of: phthalic anhydride or adipic acid; and ethylene oxide, propylene oxide, or a mixture thereof.

7. (Original) The clay-polyurethane nanocomposite according to claim 1, wherein the clay-containing diisocyanate compound shows a peak characteristic to the isocyanate group by infrared spectroscopy, after being washed with dimethylformamide.

8. (Original) The clay-polyurethane nanocomposite according to claim 1, wherein the clay-polyurethane nanocomposite further comprises a foaming agent and has a tensile strength a minimum of 10% higher than that of a pure polyurethane foam with the same density by the use of the same foaming agent in the same amount as the clay-polyurethane nanocomposite.

9. (Original) The clay-polyurethane nanocomposite according to claim 8, wherein the clay-polyurethane nanocomposite further comprises a foaming agent and has a compressive strength a minimum of 10% higher than that of a pure polyurethane foam with the same density by the use of the same foaming agent in the same amount as the clay-polyurethane nanocomposite.

10. (Original) The clay-polyurethane nanocomposite according to claim 8, wherein the foaming agents is selected from the group consisting of cyclopentane, chlorofluorocarbon, hydrochlorofluorocarbon, hydrofluorocarbon, water, and mixtures thereof.

11. (Original) The clay-polyurethane nanocomposite according to claim 1, further comprising a diol, a triol, a tetraol, a diamine or an aminoalcohol as a chain extender.

12. (Previously Presented) The clay-polyurethane nanocomposite according to claim 1, further comprising a flame retardant, a cell stabilizer, or a mixture thereof.

13. (Original) A method for preparing a clay-polyurethane nanocomposite, comprising the steps of:

- (a) mixing a diisocyanate compound with a clay;
- (b) stirring the mixture to form covalent bonds between the diisocyanate compound and silanol groups of the clay; and
- (c) mixing the covalently bonded structure with a polyol and reacting the mixture with stirring.

14. (Currently Amended) The method according to claim 13, wherein the diisocyanate compound is polymeric 4,4'-diphenylmethanediisocyanate (polymeric-MDI), monomeric 4'-diphenylmethanediisocyanate (monomeric MDI), or toluene diisocyanate (TDI)

15. (Original) The method according to claim 13, wherein the clay is present in an amount of 0.5~5% by weight, based on the diisocyanate compound.

16. (Original) The method according to claim 13, wherein steps (a) and (b) are carried out in the range of 25 to 80°C.

17. (Original) The method according to claim 13, wherein, in step (b), the mixture of step (a) is stirred at 50~500 rpm for 10~60 minutes, followed by additional stirring at 1,000~4,000 rpm for 2~24 hours.

18. (Original) The method according to claim 13, wherein the reaction of step (c) is carried out at 5~40°C.

19. (Original) The method according to claim 13, wherein the ratio NCO/OH in step (c) is in the range of from 1.0/1.0 to 1.5/1.0.

Appln No. 10/590,636
Amdt date January 23, 2009
Reply to Office action of October 30, 2008

20. (Original) The method according to claim 13, wherein the reaction of step (c) is carried out in the presence of a catalyst selected from pentamethylenediethylenetriamine, dimethylcyclohexylamine, tris(3-dimethylamino)propylhexahydrotriamine, triethylenediamine, and mixtures thereof.

21. (Original) The method according to claim 13, further comprising the step of sonicating the covalently bonded structure, after step (b), to improve the formation efficiency of covalent bonds between the diisocyanate compound and the silanol groups of the clay and the dispersability between the diisocyanate compound and the clay.

22. (Original) The method according to claim 21, wherein sonication is performed at a frequency not greater than 200 kHz and 5~80°C for 5~60 minutes.

23. (Original) The method according to claim 21, further comprising the step of adding a foaming agent during polymerization of the diisocyanate compound and the polyol after the sonication, and reacting the resulting mixture with stirring.